Tiscia (Szeged) Vol. XI, pp. 17—20 (1976)

WATER MOTION IN THE RIVER TISZA AND ITS CONNECTION WITH THE SUSPENDED MATTER CONTENT IN 1974

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(Received 30 June, 1975)

Abstract

The paper is dealing with characterizing the water motion in the Tisza that is very extreme as a result of the extraordinary weather in 1974, it is treating of the artifical interventions and effects, too, as well as of the formation of the suspended matter content.

Introduction

In 1974 the very extreme water motion, brought about by the extraordinary weather, was characteristic of the Tisza. The chemical composition of, and the biological changes in the Tisza reaches investigated by us (Tiszacsege—Tiszaroff) were determined mainly by the quantity and origin of the precipitation inducing inundations, the quality and quantity rations of the water masses coming from the watershed area, as well as by the artifical interventions (BANCSI 1975, HAMAR 1975).

Material and method

In 1974, we investigated the middle, 70 km long reaches of the Tisza regularly, at five sampling points, with fortnightly, but in some cases at the Kisköre water barrage with weekly frequency.

The measurement of the suspended matter content was carried out on every occasion by filtering the 500 ml original water sample by means of a Sartorius SM 0.45 μ membrane ultrafilter, and weighing it, after being dried, with an analytic balance of four figure accuracy.

Characterization of the water motion of the Tisza in 1974

Because of the rainless period at the end of 1973, there could not be formed any considerable snow-cover on the watershed areas. The degree of inundation at the end of the Winter and in Spring was determined by this condition, and it was of very slight course.

The postponement of spring-flood may be attributed to similar causes, as well. The formation of the "spring-flood" was determined by the sudden thaw of the mass of precipitation accumulated in the higher mountains in the form of snow (April—

May) and the water quantity of showers pouring on the watershed area (May—June) (VÉGVÁRI 1975).

From the thaw of snow-cover a negligibly water quantity has resulted. Thus the spring-flood was postponed in time, as a result of the precipitation of very large quantity that poured on the watershed areas of the Upper-Tisza and Szamos from the middle of May till the end of June. The water coming from the watershed area of the Upper-Tisza culminated at Dombrád with 2700 cc.m/sec water output. The maximum water output of the Szamos at Csenger was 1900 cc.m/sec. The Tisza flood-wave was followed by that of the Bodrog one day later, it culminated at Felsőberecki with 660 cc.m/sec. The water output of the Sajó and Hernád did not play any part at the summer inundation. The flood-wave of Tisza culminated at Kisköre with 2670 cc.m/sec water output on yune the 26th.

There poured an extremely large mass of precipitation on the watershed area of the Upper-Tisza, Szamos, Bodrog, Sajó and Hernád from the beginning of October till the end of November. The autumn-flood or "flood with leaves" (VÉGVÁRI 1975) that appeared in the earlier years, and according to the literary data, mostly levelled, not in a remarkable way, meant in 1974 the formation and passing of the largest flood-wave both in the Tisza and in some of its tributaries. At the autumn flood the Tisza culminated at Dombrád with 1850 cc.m/sec, in the Szamos at Csenger with 850 cc.m/sec water output, there arrived therefore much less water mass than in Summer from the watershed areas of both rivers. As a result of the extra-ordinary rains, a considerable flood started from the watershed areas of the Bodrog, Sajó and Hernád. The Bodrog culminated at Felsőberecki with 1050 cc.m/sec water output. The water output of the Sajó at Felsőzsolca, on October the 24th, reached 565 cc.m/sec, that of Hernád at Gesztely 520 cc.m/sec, and at the mouth they preceded the flood-wave of the Tisza, that culminated at Kisköre with 2960 cc.m/sec water output, about 5 to 6 days.

Owing to the postponement of spring-flood and the larger than usual autumn inundation, the „small-water period" that is characteristic of the Tisza, could only be formed in the month of August.

Characterization of the effect of damming up the water in the area of Kisköre River Barrage

The damming of river bed may exert a considerable influence on the chemical composition of, and biological changes in the water of Tisza (ÁDÁMOSI *et al.* 1973, BANCSI 1975, HAMAR 1975).

In 1974, the way of operating the Kisköre River Barrage was determined by the smaller or larger flood-waves following one another. As depending on the degree of floods and the time of their passing, there was a damming for 260 dasy and the water flowed without any damming for 105 days in the course of the year. Between February 10 and 14 and February 21 and 25, for four days each, from June 5 till July 20 for 45 days, between July 25 and August 3 for 9 days, and between October 14 and November 26 for 42 days there was no damming. It follows from the foregoing unequivocally that because of the extremely inordinate water motion the damming could not prove so effectual as observed in the small-water periods of the year 1973 (ÁDÁMOSI *et al.* 1973). It was remarkable that even during the comparatively short periods between floods we did notice certain characteristics of the formation of backwaters, like e. g., the increase in magnesium content, the decrease in the number

of bacteria, the appearance of phytoplanktons of backwater type, the establishment of filamentous green algae on the stony banks.

Change in the suspended matter content and its connection with the characteristic of water outputs and watershed areas

In case of different water outputs, the suspended matter content of the Tisza has changed in wide intervals (5 to 555 mg/l). The total suspended material and the water output belonging to it have shown, in the first approximation, no unequivocal connection.

In case of identical water outputs, in different times, we have measured values very different from one another, as well; on the other hand, there have often belonged different water outputs to a similar quantity of suspended matter. Taking into consideration, apart from the absolute quantities, also the character of the change in water, then we may establish the following:

The maximum value of the suspended material always preceded the culmination of flood-wave, then still before culminating it considerably decreased and, till passing of the flood-wave, anyway with smaller of larger fluctuations, it preserved an approximately standing value.

A similar situation has evolved in case of more flood-waves within a single inundation, as well (Fig. 1).

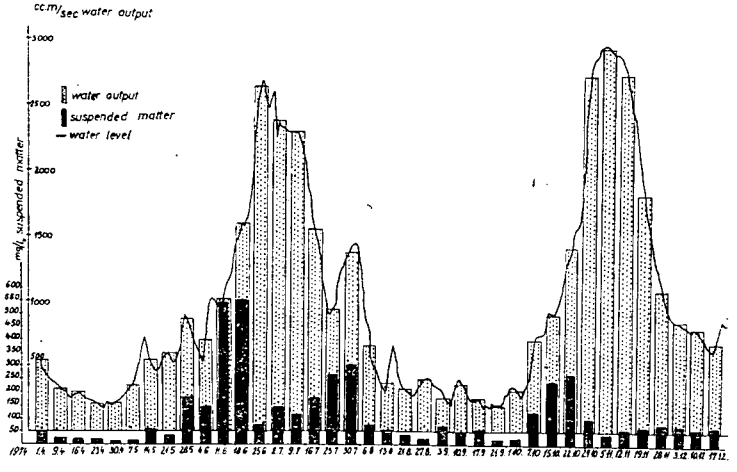

Fig. 1: Formation of the water-level, water output and suspended matter in the Tisza profile at Kisköre in 1974

Comparing the floods in Summer and Autumn we have learned that the maxima of the suspended matter measured on the occasion of the autumn flood-wave that culminated with a larger water output were essentially smaller than those of the summer flood. Investigating the conditions of the formation of both floods, we have established the following differences:

The spring-flood took place first of all as a result of the precipitation of very large mass poured on the watershed areas of the Upper-Tisza and Szamos. Most

part of its water-mass was formed by the water-mass of the Tisza and Szamos, transporting an extremely large quantity of suspended matter. As a result of that (as shown by the data of the Water Management of the Upper-Tisza Region, Inspectorate of Water Quality, from 1974), the suspended matter content was 1475 mg/l at Tokaj, on June the 16th, 555 mg/l at Kisköre on June the 18th.

At the autumn flood, there arrived a smaller water quantity than in Summer both from the watershed area of the Tisza and from that of the Szamos. In that period, however, the Bodrog and Sajó transported a considerable water mass, as well, and they carried together a larger quantity of suspended matter than the Tisza. The Bodrog contained on the 8th of October 634 mg/l, and before the mouth of Sajó, on the 17th of October 546 mg/l matter in suspension (data of the Water Management of the Upper-Tisza Region, Inspectorate of Water Quality, from 1974).

The mass of the matter in suspension of the smaller suspended load of the Upper-Tisza and Szamos measured at Kisköre remained — as a result of the temporal postponement of the flood-waves of the Bodrog and Sajó — smaller (270 mg/l on the 22nd of October), in spite of the flood being larger than that in Summer.

It was proved by the results of the investigation in 1974 that, on the occasion of flood, the momentary suspended matter content is depending not only upon the water output but, to a considerable extent, upon the character of the change in water and the conditions of the formation of flood-waves, as well.

We have established that the suspended matter content is an essential parameter from hydrochemical and hydrobiological points of view, too, exerting a strong influence on the total iron content, the calcium and magnesium content, the chemical oxygen demand (C. O. D.), the total phosphorus and total nitrogen content, as well as on the species and individual-number compostion of the aquatic flora and fauna, in the same way.

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